of man will be set at rest; and both those who believe in the original unity, and those who believe in the original diversity of races, will have that free scope given to their theoretic methods which a practically unlimited amount of time at their command is calculated to afford. Dr. Ildefonso is understood to assert that the annual character of the laminæ has been confirmed.

Pending nominations Nos. 522, 523, 524, were read, and the Society was adjourned.

Stated Meeting, June 17, 1864.

Present, six members.

Prof. Trego, Secretary, in the Chair.

Letters accepting membership were received from G. Kirchhoff, dated Heidelberg, June 2d, and from Otto Heer, dated Zurich, April 10th, 1864.

Letters acknowledging the receipt of publications were received from the Boston Athenæum, May 31st; Boston Library, June 7th; Connecticut Historical Society, May 23d; New York State Library, May 21st; New York Historical Society, May 19th; Washington Observatory, May 18th, and Chicago Historical Society, May 19th, 1864.

Donations for the Library were received from the Government of the Netherlands, Bureau des Mines, Royal Astronomical Society, Essex Institute, Harvard and Yale Colleges, Prof. Tyler, of Amherst, American Oriental Society, New York Lyceum, New York Historical Society, Academy of Natural Sciences, Franklin Institute, and Brigadier-General Dr. Hammond.

Photographic likenesses of S. F. B. Morse, Lewis Agassiz, Oswald Heer, Spencer F. Baird, E. W. Brayley, and J. F. W. Herschel, were received for the album.

The committee to which was referred the paper of Dr. Wilcocks at the last meeting, reported in favor of its publication in the Transactions. On motion, the report was accepted and agreed to.

Mr. Chase made the following communication:

The remarkable coincidence which I have pointed out, between the theoretical effects of rotation and the results of barometrical observations, has led me to extend my researches with a view of defining more precisely some of the most important effects of lunar action on the atmosphere. The popular belief in the influence of the moon on the weather, which antedates all historical records, has received at various times a certain degree of philosophical sanction. Herschel and others have attempted partially to formulate that influence by empirical laws; but the actual character of the lunar wave that is daily rolled over our heads appears never to have been investigated. Major-General Sabine showed that the moon produces a diurnal variation of the barometer, amounting to about .006 of an inch, which is equivalent to nearly one-tenth of the average daily variation near the equator. This would indicate a tidal wave of rather more than one foot for each mile's depth of atmosphere, or from three to six feet near the summits of the principal mountain chains. It is easy to believe that the rolling of such a wave over the broken surface of the earth may exert a very important influence on the atmospheric and magnetic currents, the deposition of moisture, and other meteorological phenomena. As the height of the wave varies with the changing phases of the moon,* its effects must likewise vary, in accordance with mathematical laws, the proper study of which must evidently form an important branch of meteorological science.†

Besides this daily wave, there appears to be a much larger, but hitherto undetected, weekly wave. M. Flaugergues,‡ an astronomer at Viviers in France, extended his researches through a whole lunar cycle, from Oct. 19, 1808, to Oct. 18, 1827, and he inferred, from his observations:

1. That, in a synodical revolution of the moon, the barometer rises regularly from the second octant, when it is the lowest, to the second quadrature, when it is the highest; and then descends to the second octant.

2. That the varying declination of the moon modifies her influ-

* The height at St. Helena appears to fluctuate between about .9 and 1.6 feet.

† For some interesting experimental evidences of the effect of the moon's changes on the fall of rain, see the published observations of Messrs. F. Marcet (Silliman's Journal, 27, 192), and J. H. Alexander (Silliman's Journal, N. S., 12, 1).

‡ Bib. Univ., Dec. 1827, and Silliman's Journal, 15, 174.

ence, the barometer being higher in the northern lunistice than in the southern.

3. That the action of the moon also varies with its distance from the earth, the mean barometric height being less in perigee than in apogee.

The observations indicate the following average meridional fluctuations of the barometer:

1. In a semi-synodical revolution, 1.67 mm., or .065 in.
2. Between the lunistices, 29 mm., or .011 in.
3. Between perigee and apogee, 1.12 mm., or .044 in.

The more recent and more complete observations at St. Helena give somewhat different results, which serve to confirm the natural *à priori* conviction that there must be two maxima and minima in each month. The means of three years' hourly observations indicate the existence of waves, which produce in the first quarter a barometric effect of + .004 in.; in the second quarter of — .016 in.; in the third quarter of + .018 in.; and in the fourth quarter of — .006 in.; results which appear to be *precisely* accordant, in their general features, with those which would be naturally anticipated from the combination of the cumulative effect of the moon's attraction with the daily wave of rotation, and the resistance of the æther.

One peculiarity of this lunar-aerial wave deserves notice for the indirect confirmation that it lends to the rotation theory of the daily aerobaric tides, and the evidence it furnishes of opposite tidal effects, which require consideration in all investigations of this character. When the daily lunar tides are highest their pressure is greatest, the lunar influence accumulating the air directly under the meridian, so as to more than compensate for the diminished weight consequent upon its "lift." But in the general aerial fluctuations, as we have seen, and also in the weekly tides, a high wave is shown by a low barometer, and *vice versâ*. The daily blending of heavy and light waves produces oscillations, which are indicated by the alternate rise and fall of the barometer and thermometer at intervals of two or three days.

M. Flaugergues' observations at perigee and apogee seem to show that a portion of the movement of the air by the moon is a true lift, which, like the lift of rotation, must probably exert an influence on the thermometer as well as on the barometer. On comparing the daily averages at each of the quadratures and syzygies, I found the difference of temperature too slight to warrant any satisfactory inference; but a similar comparison of the hourly averages, at hours when the sun is below the horizon, gave such results as I anticipated, as will be seen by a reference to the following

TABLE OF BAROMETRIC AND THERMOMETRIC MEANS AT THE MOON'S CHANGES.

Moon's Phase.	Average height of Barometer in inches.	Height of Weekly Tides.	Height of Daily Tides.	Height of Thermom. Daily Average.	Thermom. at 12 P.M.	Thermom. at 4 A.M.
Full, . .	28.270	—.0115 in.	.0054 in.	61.67°	60.22°	59.787°
Third Qr. .	28.289	+.0065 "	.0087 "	61.68	60.41	59.824
New, . .	28.282	+.0005 "	.0064 "	61.65	60.31	59.716
First Qr. .	28.286	+.0044 "	.0047 "	61.63	60.37	59.823

In obtaining the above averages I was obliged to interpolate for such changes as took place on Sundays or holidays, when no observations were taken. The interpolation, however, does not affect the general result; and, on some accounts, the table is more satisfactory than if the observations had been made with special reference to a determination of the lunar influences, accompanied as such a reference would very likely have been by a bias to some particular theory.

The thermometric and barometric averages show a general correspondence in the times of the monthly maxima and minima,—the correspondence being most marked and uniform at midnight, when the air is most removed from the direct heat of the sun, and we might therefore reasonably expect to find the clearest evidences of the relation of temperature to lunar attraction.

By taking the difference between the successive weekly tides, we readily obtain the amount of barometric effect in each quarter. The average effect is more than three times as great in the second and third quarters, as in the remaining half month,—a fact which suggests interesting inquiries as to the amount of influence attributable to varying centrifugal force, solar conjunction, or opposition, temperature, &c.

Although, as in the ocean tides, there are two simultaneous corresponding waves on opposite sides of the earth, these waves are not of equal magnitude, the barometer being uniformly higher when the moon is on the inferior meridian, and its attraction is therefore exerted in the same direction as the earth's, than when it is on the superior meridian, and the two attractions are opposed to each other.

I find, therefore, marked evidences of the same lunar action on the atmosphere as on the ocean,—the combination of its attraction with that of the sun producing both in the air and water, spring tides at the syzygies, and neap tides at the quadratures; and I believe that the most important normal atmospheric changes may be explained by the following theory:

The attraction and rotation-waves, as will be readily seen, have generally opposite values, the luni-solar wave being

Descending, from 0° to 90°,* and from 180° to 270°.

Ascending, from 90° to 180°, and 270° to 360°.

While the rotation-wave is

Ascending, from 330° to 60°, and 150° to 240°.

Descending, from 60° to 150°, and 240° to 330°.

From 60° to 90°, and 240° to 270°, both waves are descending, while from 150° to 180°, and 330° to 360°, both are ascending. In consequence of this change of values, besides the principal lunar maxima and minima at the syzygies and quadratures, there should be secondary maxima and minima at 60° in advance of those points.

The confirmation of these theoretical inferences by the St. Helena observations appears to me to be quite as remarkable as that of my primary hypothesis If we arrange those observations in accordance with the moon's position, and take the average daily height of the barometer, we obtain the following

TABLE OF THE LUNAR BAROMETRIC TIDES.

MOON'S POSITION. θ	MEAN DAILY HEIGHT OF BAROMETER AT ST. HELENA. 28 inches + the numbers in the Table.			
	1844.	1845.	1846.	Average. 1844–6.
0°	.2621	.3020	.2701	.2781
15	.2650	.3058	.2693	.2800
30	.2707	.3153	.2707	.2856
45	.2691	.3165	.2688	.2848
60	.2625	.3077	.2688	.2797
75	.2682	.3093	.2783	.2853
90	.2667	.3184	.2800	.2884
105	.2593	.3170	.2721	.2828
120	.2595	.3124	.2686	.2802
135	.2677	.3099	.2691	.2822
150	.2712	.3118	.2715	.2848
165	.2710	.3104	.2735	.2850
180	.2621†	.3020	.2701	.2781

* Counting from either syzygy.

† Since the tabular numbers represent the *semi-axes* of the barometric curve, and not the simple *ordinates*, the values for 0° and 180° are the same.

This table shows—

1. That the average of the three years corresponds *precisely* with the theory, except in the secondary maximum, which was one day late.

2. That the primary maximum occurred at the quadratures in 1845 and 1846, and one day before the quadratures in 1844.

3. That the primary minimum occurred at the syzygies in 1844 and 1845, and one day after the syzygies in 1846.

4. That 1846 was a disturbed year; and, if it were omitted from the table, each of the remaining years, as well as the average, would exhibit an entire correspondence with theory, except in the primary maximum of 1844.

5. That 1845 was a normal year, the primary and secondary maxima and minima all corresponding with theory, both in position and relative value.

6. That the deviations from perfect correspondence with theory can be easily explained by the relative positions of the two aerial ellipsoids of rotation and attraction.

7. That the tertiary maxima and minima, or the turning-points between the primary and secondary maxima and minima, are less stable than the primaries and secondaries.

At extra-tropical stations I should look for important modifications of the theoretical results, some of which I propose to explain in a future communication.

Mr. Lesley drew the attention of the members to the researches of M. Delesse on the quantity of "water of imbibition" and "water of the quarry" contained in rocks, published in the Bulletin of the Geological Society of France (2e ser. t. xix, p. 64, séance du 4 Nov., 1861), as having an important bearing on the ancient changes of sea-level.

The tables of M. Delesse, given on pp. 66, 69, 72, go to show that dry specimens of gypsum, limestone, chalk, slate, sandstone, gneiss, granite, &c., can be made to imbibe an amount of water equal to from 1 per cent. to 40 per cent. of their weight; and that in their natural places they hold from 1 per cent. to 30 per cent. of water permanently; granite holding 15 per cent.; argillaceous rocks 20 per cent. or more; and the magnesian rocks a still larger percentage. The whole exterior of the crust of the earth is bathed in surface water, which penetrates all its formations, and descends step by step to a depth, which is probably limited by the horizon of radiant heat equal to 100° C., that is, to a depth of at least two miles. At various stages the descending percolation, aided by a universal fissure and crevasse system, forms water horizons and reservoirs, subject to enormous hydraulic pressure, reproducing the water at the surface, either through natural springs or artificial wells. It is not too much to say, then, that 20 per cent. of the crust of the earth, to a depth of two miles, consists of disseminated and collected water. This will take into account condensation descending.

What, then, was the case in early days when the horizon of 100° C. was at the surface? We must conclude that all this water was at that time excluded from the crust, and compelled to remain above the surface as heated ascending aqueous vapor, and descending rain; and, of course, keeping the general sea-level higher than at present.

Taking the mean density of all rocks near the surface at 3.00, the 20 per cent. of water contained in a stratum of crust two miles deep, will represent more than six hundred feet of water in mass; and, taking one-third of the earth's surface as land, and confining the desiccation to the land surface alone, we have an elevation of the general level of the other two-thirds, or ocean-surface of the planet, equal to four hundred feet; enough to submerge a considerable percentage of the area of each one of the existing continents.

Pending nominations Nos. 522, 523, 524, and new nomination No. 525, were read.

On motion of the Librarian, seconded by Dr. Coates, it was ordered, that copies of Part I of the Catalogue be sent with Part I, Volume XIII, of the Transactions, in the next distribution, to Corresponding Societies which receive the Transactions.

And the Society was adjourned.